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by

M. Raquibuz Zaman & M. Asaduzzaman*

INTRODUCTION

Rice is the principal agricultural crop in Bangladesh. It constitutes roughly 81 per cent [10] of the total value of agricultural output and is the main food of its over 70 million people. It is grown in Bangladesh in both Rabi and Kharif seasons. The Rabi season roughly corresponds to the period between December to March and the Kharif season to the rest of the year. Boro rice is a Rabi crop, which is approximately 10 per cent of the total rice production. It is harvested in March-April. Aus and Aman rice are grown in the Kharif season. The Aus crop comprises approximately 28 per cent of the total production and that of Aman 62 per cent [4, No.5, Table 4.3]. Aus is harvested in July and Aman in December.

Rice being the principal food crop and the most important item in the food budget of an average Bangladesh Family, frequent fluctuation in its prices cause serious strains on the consumers and the farmers growing rice. A study of the seasonal fluctuation in rice prices and also the movements in rice prices over

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* The authors are Research Economist and Staff Economist of Bangladesh Institute of Development Economics respectively. This paper was prepared in July 1970. It was awaiting publication when the war of liberation brokeout in former East Pakistan in March 1971. No revision of the original paper has been made yet. Any comments or suggestions are welcome.

time is useful for the following reasons: (1) A clear understanding of the causes of the seasonal patterns in the fluctuation of rice prices will enable the policy makers to adopt a distribution policy (including a systematic policy regarding storage of rice) that will smooth out the fluctuation and stabilize the prices which in turn, will help the consumers to plan their budgets in advance and the farmers to get a fair price for their products (i.e., rice), and is expected to reduce the exploitation, if any, by traders of rice through speculations; (2) an understanding of the relative importance of each factor that causes changes in the rice prices over time will help the planners to decide about price policies that are relevant for the accelerated growth in rice production.

This study aims at an analysis of rice prices in Bangladesh during the 1951-52 to 1967-68 period. The study will be divided into two parts. The first part will deal with the analysis of seasonal movements in rice prices and the second part with the yearly movement of whole-sale prices of medium quality rice.

II. SEASONAL FLUCTUATION IN RICE PRICES

The analysis on the seasonal movements of prices of rice is based on the published data on wholesale prices of medium quality rice at Dacca, Chittagong, and Sylhet[1/], and on the basis

1/ Data for the provincial average wholesale prices of medium quality price were not available for all the relevant years. References have been given, however, to the provincial average prices for the years for which data could be gathered.

of the provincial average retail prices of the medium quality rice. Movements in the prices of the fine and coarse qualities of rice have also been shown in the graphs of the following pages. In order to explain the average seasonal patterns in the movement of rice prices, the period under study has been subdivided into four periods. Period I refers to the average prices of 1952-53 to 1954-55 for the wholesale prices of medium and coarse qualities of rice and the average of 1948-49 to 1954-55 prices for the retail prices of the medium quality rice. No reliable data are available for wholesale prices prior to the agriculture year (also financial year) of 1952-53. Period I coincides with the Six Year Plan of Pakistan2/. During this period no large scale imports of foodgrains were required. Bangladesh was more or less self sufficient in food. Period II, which shows the average prices of rice for the year 1955-56 to 1959-60, coincides with the First Five Year Plan period. This period witnessed large quantities of foodgrain imports (specially rice) necessitated by poor crops due to frequent floods and because of the increase in demand due to a rise in population without an accompanying increase in the growth of agricultural productivity. Period III shows the average prices of 1960-61 and 1964-65 and coincides with Pakistan's Second Five Year Plan. These years witnessed quite a reasonable growth in agriculture. During this period food administration was improved and all controls on prices and movements of rice were withdrawn. Period IV consists of the first three years of the Third Five Year Plan of Pakistan

2/ The Six Year Plan, also known as the Colombo Plan, was launched in July 1951. It was not a well integrated plan.

(1965-66 to 1969-70). Prices are the averages of 1965-66 to 1967-68 prices. Data are not available for any later year. This period witnessed the Indo-Pakistan War and its subsequent impact on the overall economy of the country, growing inefficiency and corruption in the Ayub administration, widening inequalities in income and a general political unrest and anarchy that followed. In a period of uncertainty and chaos, the seasonal fluctuation in the prices of basic necessities of life are likely to be pronounced depending largely on the confidence of the people on the ability of the government to meet contingencies. The objective of dividing the entire period under study into four sub-periods is to analyse how the factors discussed above, and those that follow, influenced the modification of the seasonal pattern of fluctuation in rice prices in Bangladesh.

Movements in the Monthly Average Minimum Retail Prices and Wholesale Prices of Medium Quality Rice

Figures 1 & 2 show the changes in the average monthly minimum retail and wholesale prices of medium quality rice. The degrees of fluctuation in the monthly prices are different in different periods. Periods II and IV experienced sharper fluctuation in prices than periods I and III. The seasonal variations in prices reflect the importance of Aman crop in the overall production of rice. Aman rice is harvested in December and January. As the harvest period approaches, prices start falling

for all the qualities of rice (see Figures 1, 2, 3 & 4). Magnitude of price fall, of course, depends on the expected volume of harvest. From September there is a downward trend in the price and it continues till sometime in January. By that time all varieties (early or late varieties) of Aman rice are harvested. Prices gradually start rising from February and continue till June. Then, from July to August, there is a small fall (with some exceptions) in prices. After August, prices rise again.

Seasonal variations in prices also reflect that Boro and Aus harvests do not have much influence on the overall rice prices. Boro is harvested in March-April and constitutes only 10 per cent of the total production. Prices (average monthly prices for the different periods) seemed not to have fallen before or after the harvest of Boro crops. Aus is harvested in July-August and constitutes 28 per cent of the total rice produce. Price fall is not sharp from June to August (see Figure 2), and it is temporary. One reason why prices do not fall much after the harvest of Aus can be found in the high fluctuations in the production of this crop. It is most vulnerable to weather conditions and natural calamities like floods and cyclones which are frequent in Bangladesh and have been frequent since 1954-55. In normal years prices fall somewhat after the Aus harvest[3/].

3/ For the monthly price data for the period under study please see Appendix-1, Table 1 and 2.

In Figure 1, the fluctuation in the prices of rice more or less conform to the seasonality in harvesting the different rice crops. The fall or increases in the monthly prices were gradual, the peak price being in September and the lowest price being in December. In periods II and III, the seasonal peak price changed from September to June. Apart from this remarkable change the seasonal pattern remains more or less the same. The peak price in June in periods II and III coincides with the highest offtake from the government storage, but is not consistent with the lowest stocks of foodgrains by the government. However, stocks remained very low from July to October [5, page 97]. The Food Department, through its procurement, storage and distribution policies, has contributed much in shifting the peak price from September to June.

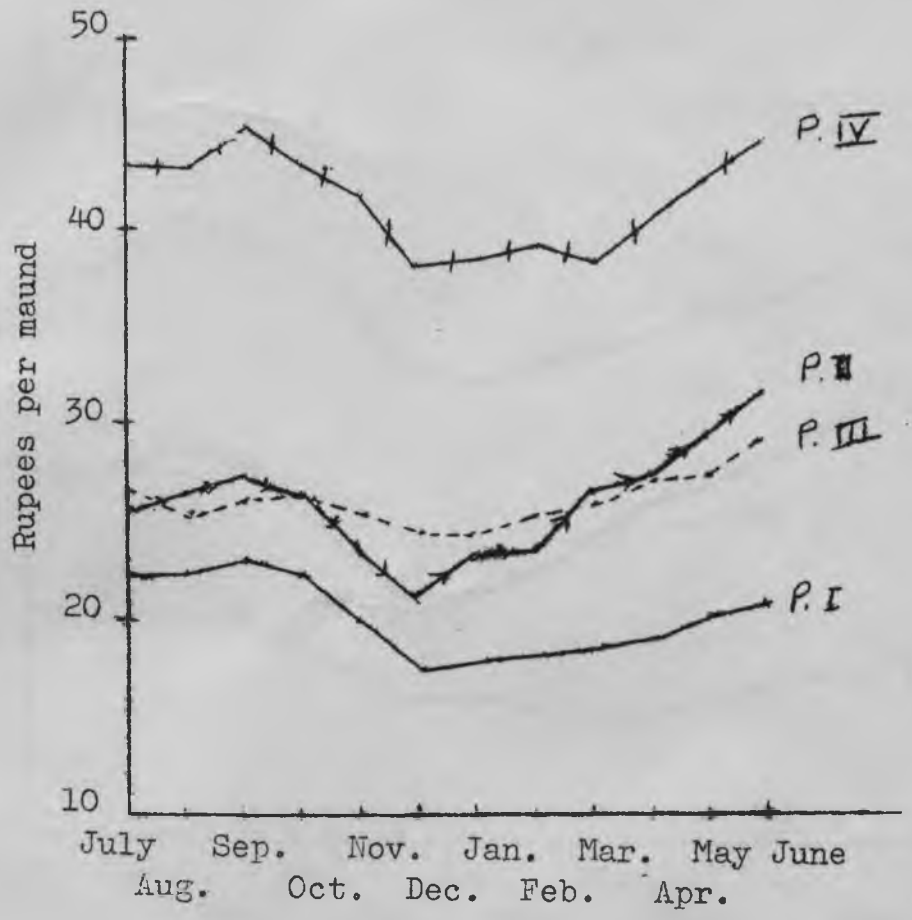
One interesting thing to be noted is that the peak price in the period IV again reversed to September from June (see Figures 1 & 2). The fluctuation in the prices were also high in period IV compared to period I and III. Except for the seasonal peak price the fluctuation in the monthly average wholesale and retail prices are similar in periods II and IV. As explained earlier, both these periods witnessed considerable unstable situations in the country (some further explanations will be given later). The movements of the retail and wholesale prices should be in the same direction, but, as the graphs show, it is not always the same. This is probably because of

the errors in data that are inherent in such cases. The sources of the retail and the wholesale prices are different, and this may explain some unexplainable irregularities in the pattern of fluctuation in prices. One should not, however, get very touchy about this kind of minor problem. The fluctuation in the monthly prices are minimal in period III due to better distribution policies, policies on agricultural prices and storage, and also due to systematic imports of large quantities of foodgrains under P.L. 480. The range between the seasonal peak and lowest prices is about Rs.5 in period III as against Rs.6 in period 1, Rs. 10 in period II and Rs. 7 in period IV[4/].

From Figures 1 and 2, it can be seen that the general level of prices are substantially higher in period IV as compared to period II and III. One possible explanation for this would be that the official estimated figures of rice production are faulty, i.e., they are overestimated. The overestimation of production resulted in much less quantities of imports of food grains to meet the provincial scarcity of food. As a result of scarcity and an excess demand for food (along with the general inflationary situation in the country), the prices of rice, the main food in Bangladesh, rose tremendously. Since the shortage of food persisted, the general price level of rice contined to remain high over this period.

4/ See Appendix-1, Table - 1.

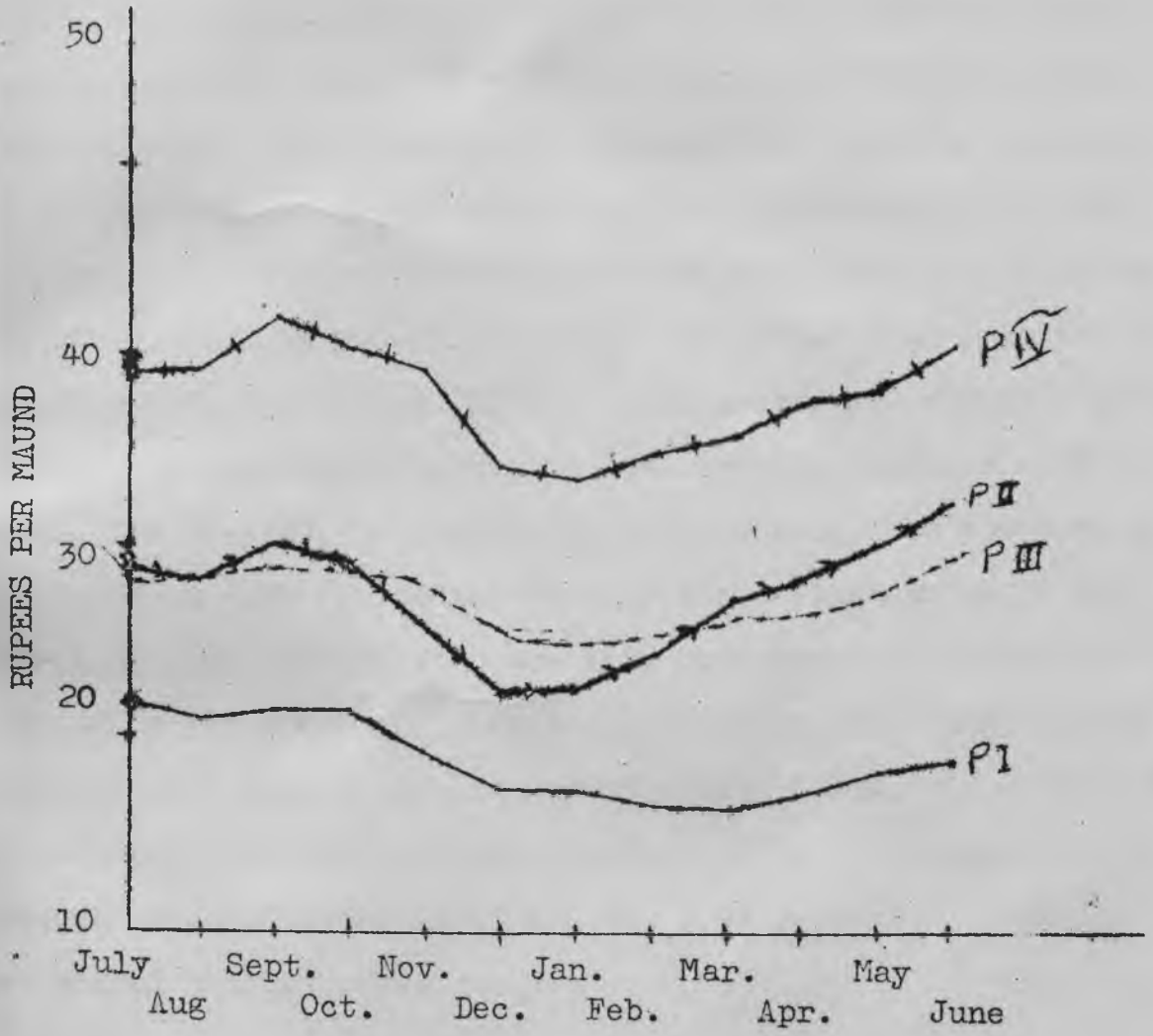
FIGURE-1. MOVEMENTS IN THE MONTHLY AVERAGE MINIMUM RETAIL PRICES OF MEDIUM QUALITY RICE (BANGLADESH)



Note: P.I. = Average of 1948-49 to 1954-55 prices
P.II = Average of 1955-56 to 1959-60 prices
P.III = Average of 1960-61 to 1964-65 prices
P.IV = Average of 1965-66 to 1967-68 prices

Source of Data: See Appendix-1, Table - 1.

FIGURE-2: MOVEMENTS IN THE MONTHLY AVERAGE WHOLESALE PRICES OF MEDIUM QUALITY RICE (BANGLADESH)



Note: P.I. = Average of 1952-53 to 1954-55 prices
P.II = Average of 1955-56 to 1959-60 prices
P.III = Average of 1960-61 to 1964-65 prices
P.IV. = Average of 1965-66 to 1967-68 prices

SCURCE: See Appendix-1 Table 2.

Movements in the Monthly Average Wholesale Prices of Fine and Coarse Qualities of Rice

In Figure 3, movements in the wholesale prices of fine quality rice are shown. Data are not available for the period before 1960-61; as a result, the graphs only show the movements in periods III and IV as defined earlier. Movements of prices in period III seem quite different from the other prices so far discussed. This is probably because the prices from July to December shown in period III are the averages of only four years, while the prices from January to June are the averages of five years. The seasonal pattern of prices are more less the same in period IV as that for medium quality rice. Fluctuation in the prices of fine quality rice are more pronounced than the fluctuation in the prices of medium quality rice. The range of the seasonal peak prices and the lowest prices (i.e., the difference between the peak and the lowest price) is Rs. 9 in both the periods as compared to Rs. 5 and Rs. 7 in periods III and IV for medium quality rice.

Figure 4 shows the movements of prices of coarse quality rice in the four periods discussed above. Seasonal fluctuation in the prices are least pronounced in the case of course rice. The explanations of price movements of medium quality rice are also applicable for the coarse quality rice. The range of seasonal peak prices and the lowest prices is about Rs. 5 in period 1, Rs. 7 in period II, Rs. 3 in period III and about

Rs. 6 in period IV.

Figure 5 shows the relative price fluctuations in the average wholesale prices of fine, medium, and coarse qualities of rice for the period 1952-53 to 1967-68. As can be seen from the figure, the fluctuations in the prices of rice are most pronounced for fine quality rice, less for medium quality rice, and the least for coarse quality rice. The pattern of seasonal fluctuation in the prices of medium and coarse qualities of rice are the same. In the case of fine quality rice the seasonal peak price is attained in October and the lowest price during February. The reason for this deviation from the general pattern is not clear. If the bulk of fine rice is imported, say from Pakistan, then it is quite possible that the interregional import pattern will determine the seasonal price fluctuation in the fine quality rice.

An understanding of the pattern of seasonal price movements is essential to formulate proper price and distribution policies. Given the nature of the supply pattern of rice (i.e., resulting from the cropping pattern) within a crop year and given the estimated aggregate demand for rice, one can formulate an optimum storage policy which can ensure an even distribution of supply of rice throughout the year and thus stabilise prices.

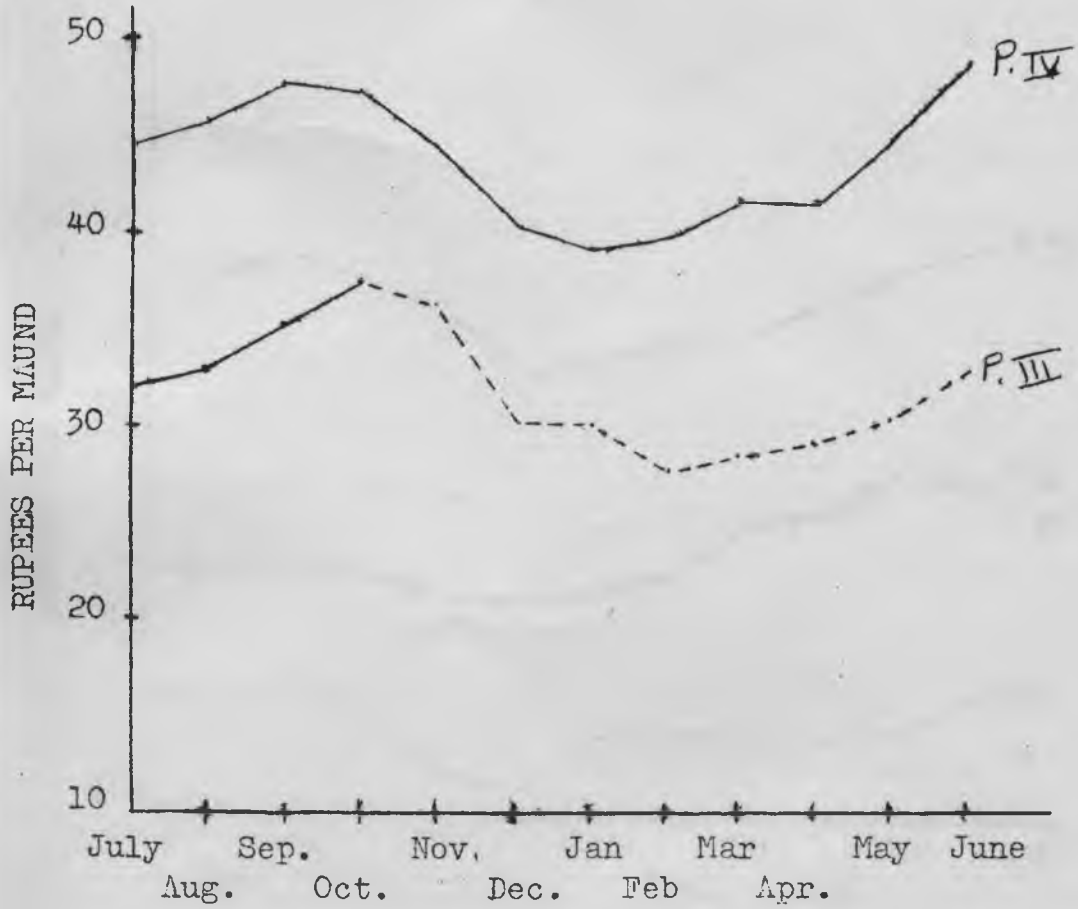
Yearly Movements in the Wholesale Prices of Medium Quality Rice in Bangladesh

Figure 6 shows the yearly movements in the wholesale prices of medium quality rice in Bangladesh. Yearly fluctuations in prices were quite sharp during the period 1951-52 to 1957-58. In 1951-52 the average wholesale price of medium quality rice was Rs. 23.92 per maund. By 1954-55 prices came down to Rs.13.83 per maund -- a fall of more than Rs. 10.00 in course of about three years. Prices rose very sharply from 1954-55 to 1956-57. The rise in prices in the course of this two year period was about Rs. 15.00 or more than double the actual price of 1954-55 (see Appendix-1, Table 5). The high rate of fluctuation in the prices during the period prior to 1957-58 can be explained in terms of the high fluctuation in the production of rice, unaccompanied by systematic exports or imports of foodgrains or proper governmental policies regarding storage and distribution. The sharp fall in the price of rice in 1953-54 (which continued till 1954-55) is attributed to the record crop of rice in Bangladesh and wheat in Pakistan. The stock of rice rose over two hundred thousand tons in Bangladesh. In view of inadequate storage facilities and apparent improvement in the general food situation, stocks were soon released which had a dampening effect on the prices. Exports of a limited quantity of rice were arranged and the Food Administration was abolished. The unprecedented floods in the autumn of 1955 damaged badly both Aus and

Aman crops and even stored food grains. These factors combined with the absence of the Food Administration, created speculation in the province resulting in panicky buying, hoarding, /etc., and thereby raising prices to a record high. In a place like Bangladesh, where the frequent floods and cyclones cause considerable damage to crops, prices depend largely on the confidence of the people in the ability of government to meet contingencies. Any knowledge or speculation about the inadequacy of government reserves create profound pressure on the prices [12, pp-36443_7. To cope with the food crisis, the government had to reinstitute the Food Administration in 1955-56.

The fall in prices from Rs.28.85 in 1956-57 to Rs.25.12 in 1957-58 was not only because of higher production in that year, but also because of imports of rice exceeding half a million ton. The yearly fluctuation in prices were relatively moderate during the period 1957-58 to 1964-65. During this period, the production of rice improved and systematic channels were developed to import rice and wheat to offset domestic shortages of foodgrains. The provincial storage facilities were somewhat augmented. In 1960 all restrictions on prices and movements of rice were removed. Fluctuation in the prices were reduced by better food administration and timely release of imported rice and wheat, both commercial imports and imports, under the P.L. 480 agreement. The index number of wholesale prices (with 1959-60 price as the base year price) between

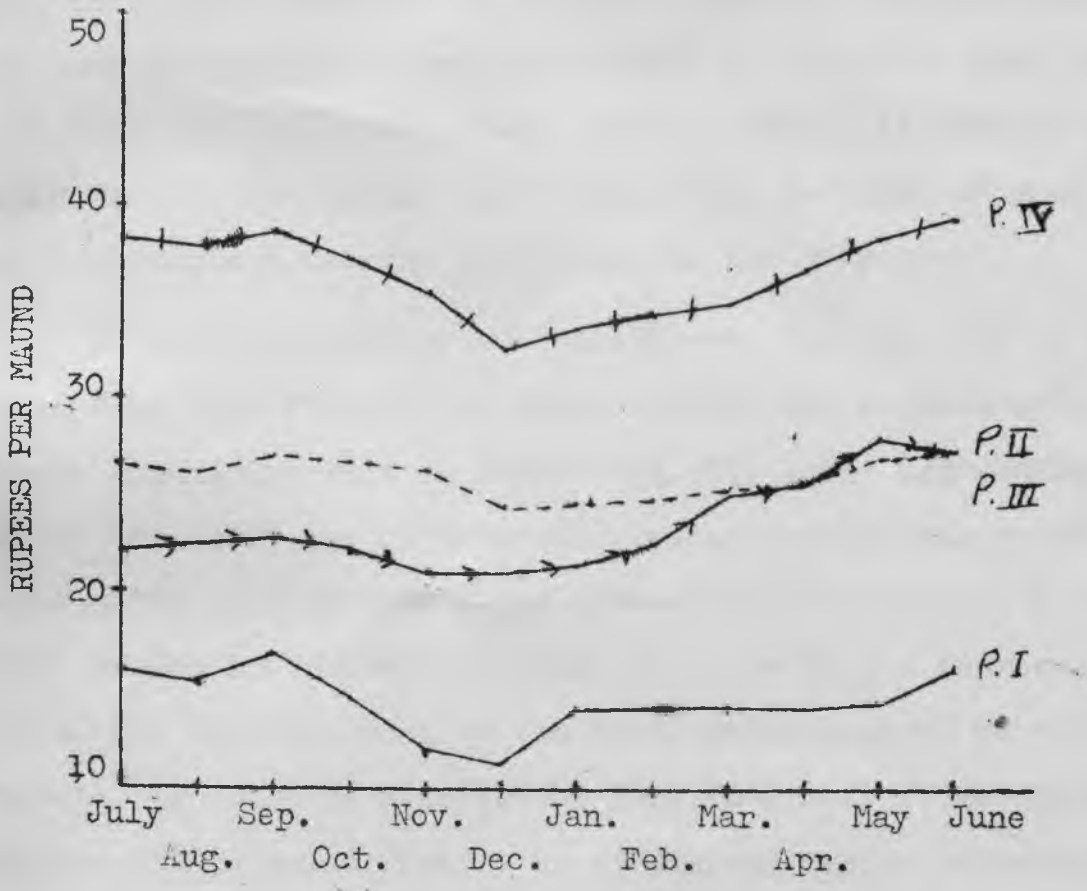
FIGURE-3: MOVEMENTS IN THE MONTHLY AVERAGE WHOLESALE PRICES OF FINE QUALITY RICE (BANGLADESH)



Note P.III = Average of 1960-61 to 1964-65 prices
P.IV = Average of 1965-66 to 1967-68 prices.

SOURCE: See Appendix-1 Table-3.

FIGURE-4: MOVEMENTS IN THE MONTHLY AVERAGE WHOLESALE PRICES OF COARSE QUALITY RICE (BANGLADESH)



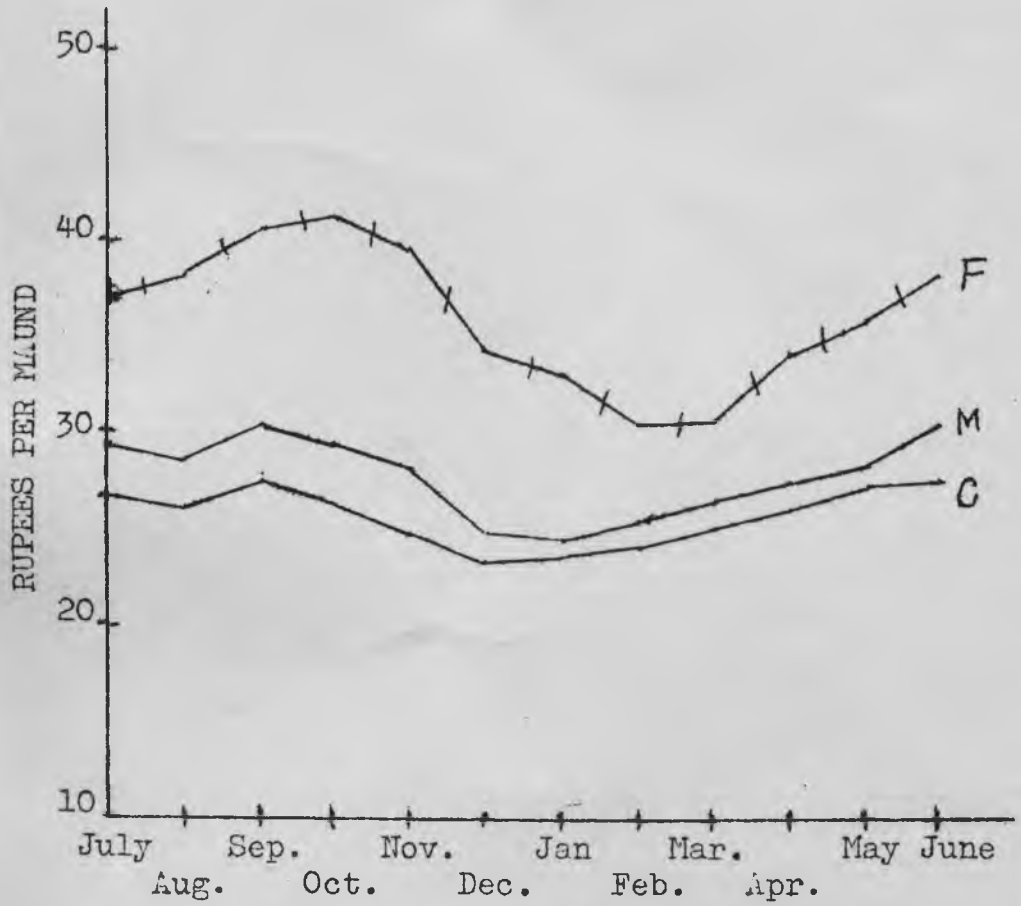
Note: P.I. = Average of 1952-53 to 1954-55 prices
P.II = Average of 1955-56 to 1959-60 prices
P.III = Average of 1960-61 to 1964-65 prices
P.IV. = Average of 1965-66 to 1967-68 prices

Source: See Appendix-1, Table-4.

1960-61 to 1964-65 has been above 110 for only 3 months. The government was less successful in maintaining minimum prices. After the record harvest of rice in 1963-64, the index of wholesale price fell from 112 to 74 inmine months, The government did not have sufficient storage facilities to store the rice for later use [10, page 154]. The sharp fall in prices in 1953-54 and again in 1963-64 perhaps can be explained in terms of good crops and insufficient storage facilities by the government.

Prices rose sharply during 1965-66, the 1st year of the Third Five Year Plan. There was a slight fall in production, though population went on increasing. The brief Indo-Pakistan War in late 1965 and unfavourable weather conditions probably explain the fall in output and consequent price rises. Prices rose further by 1966-67. The rise in price in one year was over Rs. 10 per maund. A fall in the total production is partially responsible for this significant rise in price. It is doubtful whether the reported figures of production really reflected the actual production of rice during this period. It is quite possible that the officials inflated actual production figures in order to hide the debacle of their agricultural policies pursued after the September War. Though prices fell momentarily in 1967-68, the upswing in prices still continues. Apart from unfavourable weather conditions and the impact of the September War, the general political unrest in the country also created an unstable situation

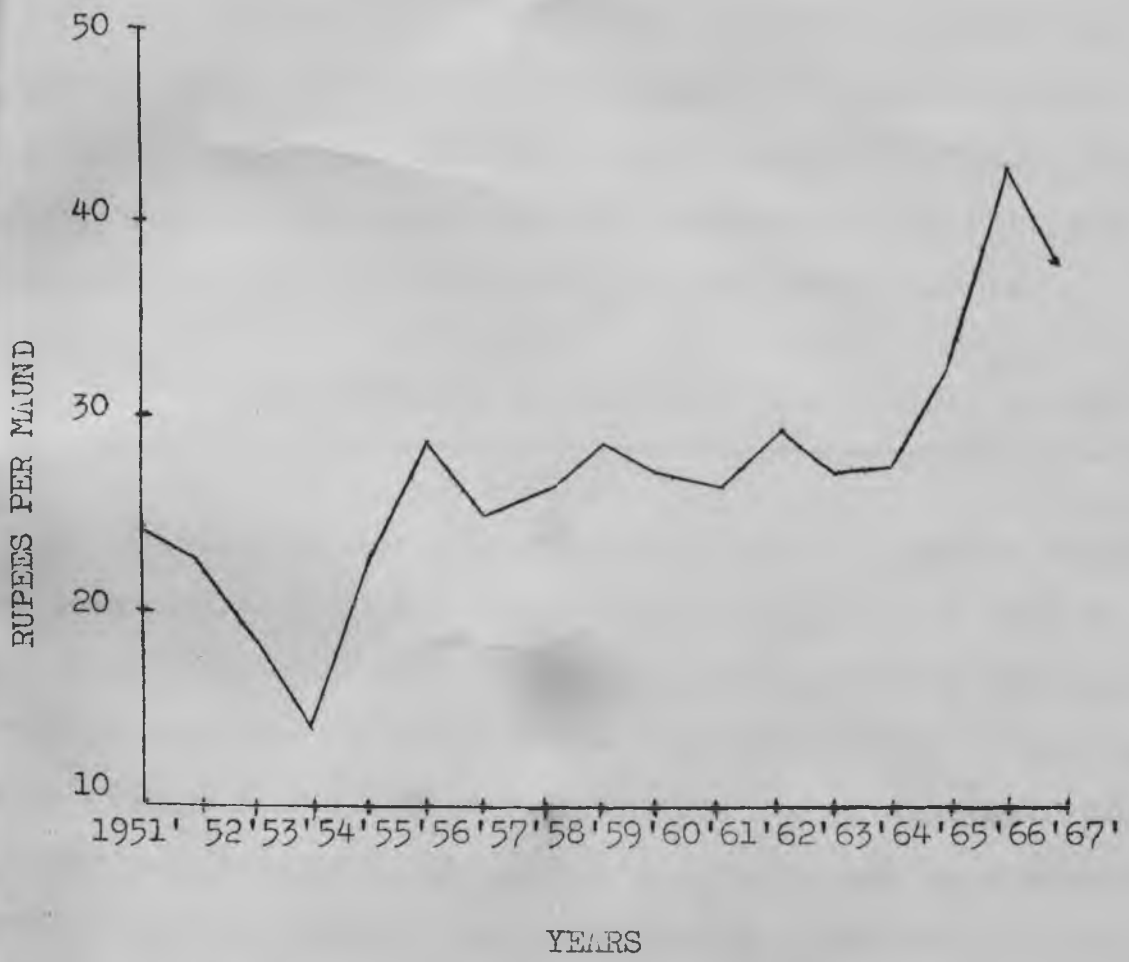
FIGURE-5: MOVEMENTS IN THE MONTHLY AVERAGE WHOLESALE PRICES OF FINE, MEDIUM AND COARSE QUALITIES OF RICE IN BANGLADESH DURING 1952-53 to 1967-68 PERIOD[a]



a/ For the fine quality rice the averages are for the period 1960-61 to 1967-68. Data for earlier years were not available.

SOURCE: See Appendix-1, Table 2,3 and 4.

FIGURE-6: YEARLY MOVEMENTS IN THE WHOLESALE PRICE OF MEDIUM QUALITY RICE IN BANGLADESH



Note: 51' = 1951-52, 52 = 1952-53 etc.

SOURCE: Appendix-1, Table 5.

in agricultural production and prices. This is reflected in sharper seasonal fluctuation and the overall higher level of prices.

The analysis so far has been concerned only with the possible causes of the price fluctuations at the different time periods. In order to examine the importance of different quantifiable factors in determining rice prices over the past 17 years, the analysis will now focus on a few analytical models.

III. EFFECTS OF DIFFERENT VARIABLES ON THE FLUCTUATIONS OF RICE PRICES

In this section efforts will be made to analyse the effects of some variables on the fluctuation of rice prices with the help of three regression models. The first model relates prices of rice (medium quality rice) to the available supply of all qualities of rice from provincial production and to aggregate rural demand for foodgrains. The second model includes an additional variable money supply in the province. The third model includes imports of foodgrains but drops money-supply as one of the explanatory variables. The results of the three models are then compared to isolate the effects of money supply and imports of foodgrains on the fluctuations of rice prices.

Before the results of the regression models are analysed, it will be worthwhile to explain the rationale behind the selection of the variables and their estimation prooedure. The five

variables considered in the analysis of this section are as follows:-

P = Average yearly wholesale price of medium quality rice in Bangladesh in terms of rupees per ton (where 1 tons = 2,240 lbs.)

R = Available supply of all qualities of rice from provincial production in terms of million of tons

D = Aggregate real demand for foodgrains in terms of million of tons.

M = Money supply in the province in terms of crore of rupees

I = Imports of foodgrains from international markets and from Pakistan.

All the variables refer to the current year. Definitions, source and nature of the available data for these variables are discussed below.

P : Average yearly Wholesale Price of Medium Quality Rice.

The average wholesale prices of crop years (July-June) have been selected as the dependent variable. The prices have been quoted in terms of ruppes per ton. The use of price per ton instead of price per maund was necessary to minimise the differences in the size of units between the dependent and independent variable. The data is the simple arithmetic mean of published wholesale price of medium quality rice in some urban areas; namely Dacca, Chittagong, Sylhet, Khulna and Rajshahi. No other

reliable series of data were available. Because of lack of data on quantity marketed in each of the urban centres, a weighted average price of rice could not be estimated.

One difficulty with the approach of relating average wholesale prices to the total production of the year is that the effect of next year's production is likely to influence that price in question. One possible alternative would have been to relate the price of a particular month to the total production of the crop year. The selection of the particular monthly price is dependent on the nature of time lags between agriculture production and prices. One can select such a monthly price by examining the anticipatory behaviour of the buyers and sellers [see: 14, pp. 188-199 as well as 2 and 9 for application of the theory in the Indian case] under some basic assumptions[5/]. It is difficult to decide about a particular price which can be justified on all grounds of theoretical and empirical considerations. The selection of the average yearly price eliminates the problem of selecting a price which satisfied all the theoretical considerations but does not necessarily improve the quality of the exercise.

5/ The assumptions are: 1) Perfect competition among the traders, 2) Adequate access to knowledge by traders and 3) No exogeneous factors in the determination of current prices and no significant change in the price mechanism from one year to another. For further details see [14].

R : Supply of rice from domestic production -- Supplies of rice from domestic production are derived by deducting 10% of the total yearly production on account of waste, seed, feed, and changes in stock[6]. The figures are in terms of tons of cleaned rice (see Appendix-1, Table 6). This is important determinant of rice prices.

D : Aggregate real demand for food grains. -- It is assumed that the price of rice is related to the aggregate real demand for food grains and hence, this is included as one of the explanatory variables. The steps involved in the computation of this variable are as follows [see also 2, pages 43-51].

It is assumed that the demand for food grains is a function of real income and prices of foodgrains. Under this assumption estimates were made of real demand for each year by changing the real income, but keeping prices constant. Once the base year consumption, real income changes from that period, and also the growth of population since then are known, one can easily determine the real demand for subsequent periods. For arriving at the base year consumption figure, one can approximate the total available supply of foodgrains (production minus 10 per cent of production for seeds, feed, and wastage ± changes in stocks ± imports) as equivalent to the demand. Data for the changes in the real income

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6/ This is the usual procedure of estimating available supply adopted by the Pakistan Planning Commission.

are available (income at constant prices) from the published sources. Data are also available for income elasticity of demand for Bangladesh. The available estimates, based on cross-sectional data, are, however, not consistent with each other. The FAO calculation [13] shows the income elasticity of demand to be 0.4 while the study of Dr. Nurul Islam [7] shows it to be 0.3. Research scholars, in general, however, believe that the income elasticity of demand in a low income country like Pakistan will be between 0.5 to 0.7. The figure used in this study is 0.5. It is also assumed that the income elasticity of demand will be constant for the period under study. This is not likely to be a serious assumption in view of the fact that the pattern of income distribution and also the per capita real income has not changed much in Bangladesh since 1947-48 [8, pages 199-204].

On the basis of constant income elasticity of demand of 0.5, per capita demand for each year was estimated. Then these estimates were multiplied by the population figures to get the aggregate real demand for foodgrains for the province. The estimated real demand figures have been presented in Appendix-1, Table 7.

1: Imports of foodgrains from international markets and Pakistan

Imports of foodgrains are thought to be one of the important determinants of price as they affect the overall domestic

supplies. The data used are shown in Appendix-1, Table 8.

M: Money supply -- These figures are presented in Appendix-1, Table 9 and are in terms of crore of rupees. Money supply is defined as money in circulation plus demand deposits held in the province. Published data are available only for the period 1959-60 to 1967-68. The figures for the previous years were estimated on the basis of the trend in the later years. It was found that the published figures of provincial money supply was roughly 29 per cent of the overall money supply in Pakistan. It was assumed that the ratio was the samin the previous years also.

Having discussed the nature of the variables and their estimation procedure, it is now possible to analyse the causes of price fluctuations by formulating the following functional relationships.

Determinants of Price Fluctuations

Model - 1

Let $P = \alpha + \beta_2 R + \beta_4 D$

where the variables P, R, and D are the same as discussed above. β's are the coefficients of the explanatory variables. The results of the multiple Linear regression are as follows:-

$$P = 22.22 - \underset{(42.31)}{80.90} R + \underset{(42.94)}{187.28} D$$

where the figures in parenthesis are the standard errors of the respective coefficients. The multiple coefficient of determination or R^2 is .72 indicating that 72 per cent of the variations in prices of medium quality rice are explained by the independent variables R and D. When the R^2 is adjusted for degrees of freedom, it is found that about 68 per cent of the variations are explained by these variables. The F-statistic is highly significant at 1 per cent level of significance indicating that the regression coefficients are significantly different from zero.

The coefficient of R is -80.90 which means that a rise in the supply of provincially produced rice by one unit, i.e., a million tons in this case, will reduce the price by Rs. 80.90 per ton or about Rs. 2.97 per maund. The computed t value is 1.91 and is close to the standard t value at 5 per cent level of significance (2.14). Thus, the value of the coefficient R is, roughly, significantly different from zero.

The coefficient of the aggregate real demand for food-grains is 187.28 implying that a unit (i.e., a million tons) increase in D will lead to an increase in price by Rs. 187.28 per ton or Rs. 6.88 per maund. The computed t statistics (4.36) show that it is highly significant at 1 per cent level of significance indicating that the coefficient is significantly different from zero.

Model - 2

Model 2 includes one additional variable -- M, the money supply, as defined earlier. The model is as follows:-

$$P = \alpha + \beta_r R + \beta_d D + \beta_m M$$

where R, D, and M are three explanatory variables as described earlier in this section. The results of the linear multiple regression are as follows:-

$$P = 988.14 - \underset{(71.20)}{20.85}\,R - \underset{(146.76)}{108.95}\,D + \underset{(2.05)}{4.38}\,M$$

where the figures in parenthesis are the standard errors of the respective coefficients. The multiple coefficient of determination R^2 is .79 indicating that 79 per cent of the variations in the price are explained by the variables R, D, and M. The adjusted R^2 (i.e., $\bar{R}^2$) is .75. Though the R^2 improves in this model due to the inclusion of the variable money supply the coefficients of R and D become statistically insignificant. However, the F statistic (16.60) is highly significant at 1 per cent level of significance indicating that the regression coefficients are significantly different from zero.

The coefficient of R is - 20.85, which means that a unit increase in the domestically produced rice (a million tons) decreases the price by Rs. 20.85 per ton (Rs.0.77 per maund). The sign of the coefficient is alright, but the coefficient is not statistically significant. The reason for this will be explained shortly.

The coefficient of D is - 108.95 which means that a unit increase in the aggregate real demand (a million tons) will reduce the price Rs. 108.95 per ton (Rs. 3.99 per maund). Thus, the inclusion of money supply apparently affected the sign of the coefficient. For all logical grounds the sign of D should be positive. There seems to be a high positive intercorrelation between money supply, as defined above, and the aggregate real demand. This has probably resulted in multi-collinearity and hence, changed the sign of the D coefficient. Because of multi-collinearity it is quite possible that the coefficients are not statistically significant.

The coefficient of M is + 4.38 which means that if the money in circulation increases by a crore of rupees, the price of rice goes up by Rs. 4.38 per ton (Rs. 0.16 per maund). The sign is logical and the coefficient is significant at 5 per cent level of significance[7/].

Model - 3

This model drops money-supply as one of the explanatory variables and includes imports of foodgrains instead. The results of the linear regression are as follows:-

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7/ The study by Rabbani and Repetto [11, pages 281-287] shows that an increase in the money supply by a crore of rupees appreciates the retail price of coarse rice by Rs. 0.06 per maund. Their function is different from the one presented above in several respects. First, they consider average retail price of coarse rice, Second, their explanatory variables are per capita availability of total foodgrains and money supply, and finally, their regression only involves the period 1959-60 to 1967-68, whereas the one presented above covers the period 1952-53 to 1967-68.

$$= 93.80 - \underset{(62.40)}{63.27\ R} + \underset{(41.59)}{135.63\ D} + \underset{(74.31)}{108.07\ I}$$

where the figures in parenthesis are the standard errors of the coefficient. The multiple coefficient of determination or R^2 is .79 or 79 per cent of the variations in rice prices are explained by the interactions of the explanatory variables. The adjusted R^2 (or $\bar{R}^2$) is .72. The computed F statistic is 11.14 and is highly significant at 1 per cent level of significance meaning that the regression coefficients are significantly different from zero.

The coefficient of R is 63.27 which means that an increase in the domestically produced rice by one million tons will result in a decrease in the price per ton by Rs. 63.27 (or by Rs. 2.32 per maund). The coefficient is not statistically significant, however. The coefficient of aggregate real demand is 135.63 indicating that an increase in the real demand by one million ton increases the price of rice by Rs. 135.63 per ton (Rs. 4.98 per maund). This coefficient is significant at 5 per cent level of significance.

The coefficient of imports is 108.71 indicating that an import of one million tons of rice will increase the price of rice by Rs. 108.71 per ton (or Rs. 3.99 per maund). The sign of the coefficient is thus contrary to general expectations, as imports should really have a moderating effect on prices. There is possibly an explanation for the positive sign of this

coefficient. The need for imports occur where there is a shortage of domestic production (implying high prices of rice). Thus, imports may be dependent on price but not vice versa. However, if the arrangements for imports are of long-term nature and imports are uniformly distributed over the contract period, no matter what are the sizes of production, then prices will be affected by imports and not the other way round. The sign of the import coefficient implies that the imports are probably done on an ad hoc basis rather than on any long-term contractual agreements. It should be pointed out here that the coefficient of imports is not statistically significant anyway.

The results of all the three models are presented in Appendix-1, Table 10 for a quick reference. The models have been tested for their power of predictability. This has been done by comparing actual prices with the predicted prices given by each model (see Figures 7, 8 and 9). It is found that Model-1 tends to overestimate prices more or less consistently[8/]. Model 2 appears to give the best fit. Predicted values are quite close to the actual values. Model 3 also gives good results[9/].

8/ This is probably because of the existence of positive autocorrelation in the error terms. The Derbin-Watson test was used and it was found that the error terms (i.e., disturbances terms) were positively correlated. The autocorrelation has arisen probably because of wrong specification of the model.

9/ Model 3 has lesser number of observations than model 1 and 2. This is because no data were available for imports for the period prior to 1955-56.

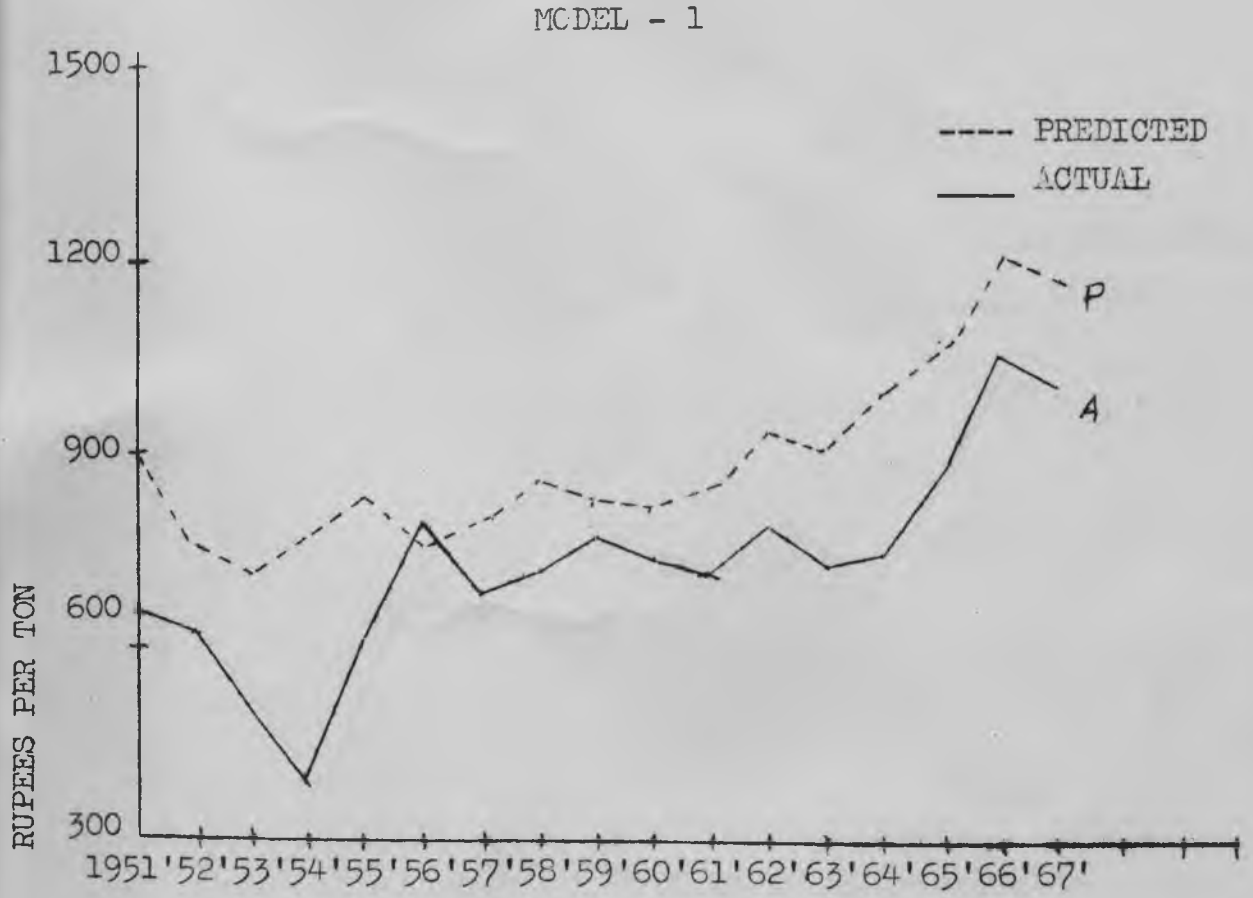
IV. CONCLUDING REMARKS

An attempt was made in this study to analyse the seasonal fluctuation in rice prices in Bangladesh from the period 1951-52 to 1967-68 on the basis of published data on retail prices of medium quality rice and wholesale prices of coarse, medium and fine qualities of rice. The total period under study was divided into four sub-periods for the study of seasonal movements in prices. It was found that fluctuation in the prices of rice were the least during the sub-period 3 which coincides with the period under the Second Five Year Plan. Fluctuations were more pronounced in sub-periods II and IV corresponding to the period of theFirst Five Year Plan (1955-60) and the first three years of the Third Five Year Plan (1965-68). The possible causes of fluctuation in the prices, and also shifts in the period of seasonal peak prices, were explained.

Causes and the nature of the movements of yearly wholesale prices of medium quality rice were then analysed. Three regression models were tried. Model 1 relates price to domestically produced rice and aggregate real demand for foodgrains. Model 2, includes an additional variable money supply and Model 3 relates price to the two variables included in model 1 and an additional variable, imports of foodgrains. The multiple coefficients of determination for each model were reasonably high (i.e., 0.72, 0.79 and 0.79, respectively, for models 1,2 and 3). Each of the models were tested for its power of predictability. Model 2 appears to give the best results and model 1 the worst. Model 1 tends to overestimate the actual prices consistently[10/]. Results of Model 3 are also satisfactory as predicted prices are reasonably close to actual prices.

10/ See footnote 8.

FIGURE-7: PREDICTED AND ACTUAL WHOLESALE PRICES OF MEDIUM QUALITY RICE IN BANGLADESH



(YEARS (51' = 51-52 and so on)

FIGURE-8: PREDICTED AND ACTUAL WHOLESALE PRICES OF MEDIUM QUALITY RICE IN BANGLADESH

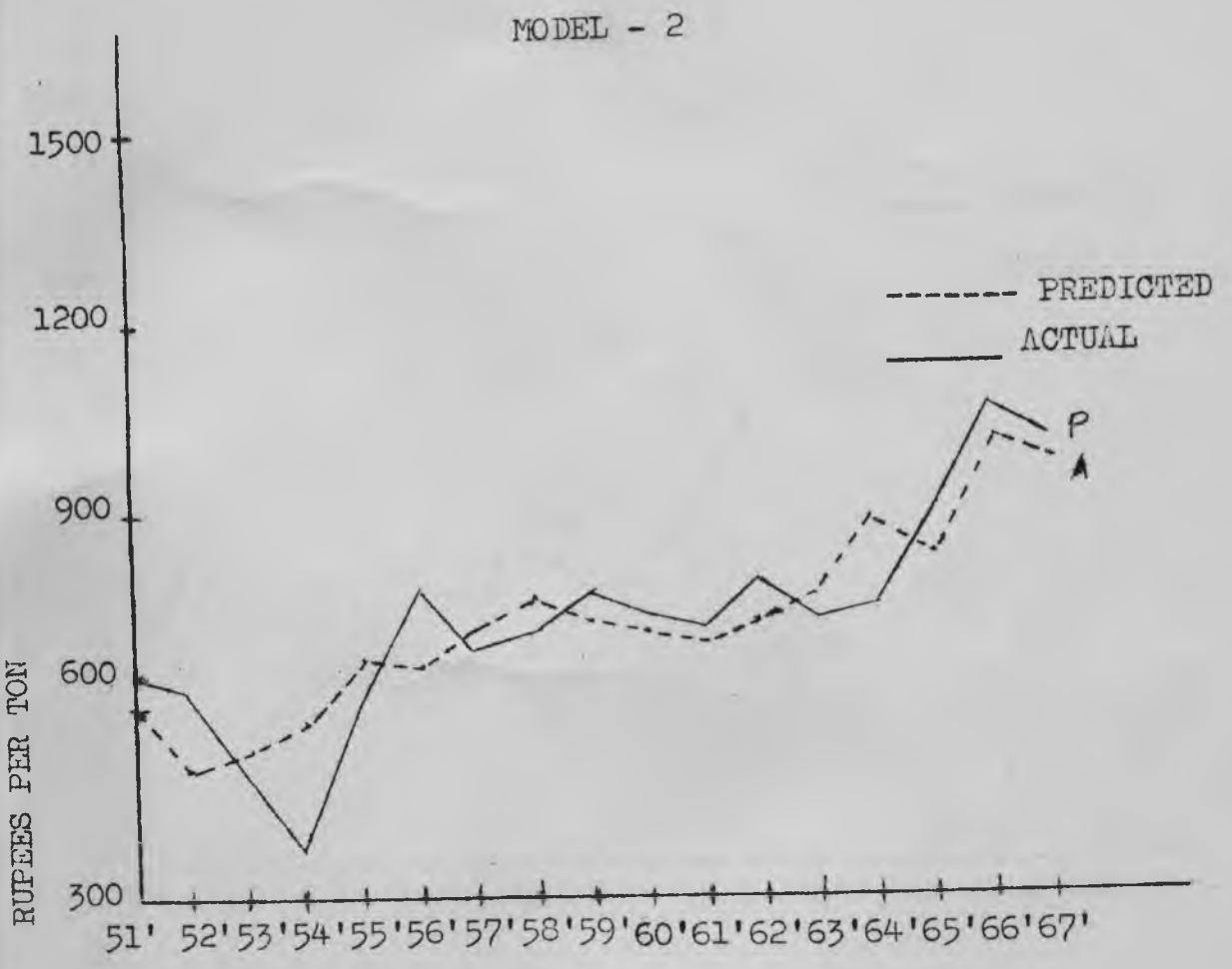
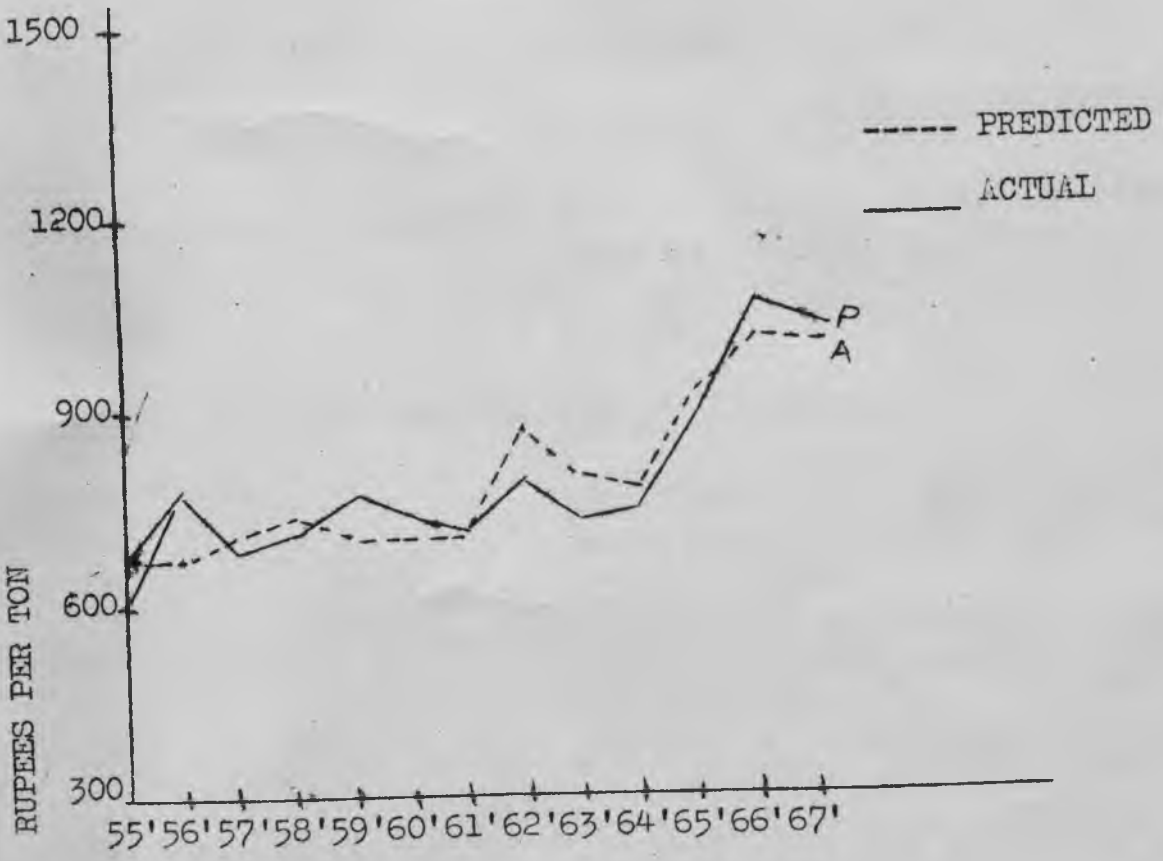


FIGURE-9: PREDICTED AND ACTUAL WHOLESALE PRICES OF MEDIUM QUALITY RICE IN BANGLADESH

MODEL - 3



YEARS (55' = 55-56 and so on).

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TABLE - 1

Monthly Provincial Average of Minimum Retail Price of Rice in Bangladesh
(Per Maund)

Year	July	August	September	October	November	December	January	February	March	April	May	June	Yearly Average
1948-49	27.31	29.19	30.88	33.25	32.44	25.75	25.19	26.81	27.62	28.56	30.50	32.37	29.16
1949-50	29.56	30.88	33.69	32.19	23.81	18.81	19.06	18.62	17.00	17.06	19.00	22.19	23.49
1950-51	21.00	20.94	20.37	18.88	16.56	14.81	15.50	17.75	19.25	20.13	21.25	21.94	19.03
1951-52	21.31	21.62	22.31	22.25	21.31	20.00	21.37	21.81	21.25	21.44	23.19	23.50	21.78
1952-53	22.69	21.94	22.56	2313	21.25	17.44	18.44	18.56	19.00	23.75	23.19	22.69	21.22
1953-54	22.69	20.81	20.44	17.44	14.94	13.44	13.50	13.06	12.69	11.19	11.81	11.75	15.31
1954-55	11.69	11.69	11.50	10.81	9.69	9.94	10.62	10.19	10.19	10.62	11.06	12.44	10.87
Average	22.32	22.44	23.11	22.56	20.00	17.17	17.67	18.11	18.14	18.96	20.00	20.98	
1955-56	12.62	15.06	15.25	14.62	17.44	16.44	17.62	22.37	23.69	26.06	29.37	33.31	20.32
1956-57	33.50	32.50	40.88	42.69	31.25	23.37	29.50	24.62	29.25	29.75	34.00	36.13	32.29
1957-58	29.25	30.44	29.25	25.37	22.37	23.37	22.19	22.56	25.13	25.81	27.44	26.75	25.83
1958-59	25.88	26.62	25.88	24.81	22,88	20.19	21.94	24.37	26.81	27.88	27.50	29.00	25.31
1959-60	26.94	26.56	26.94	26.37	24.31	22.44	24.06	25.00	27.06	28.06	28.94	30.84	26.46
Average	25.64	26.24	27.64	26.77	23.65	21.16	23.06	23.78	26.39	27.51	29.45	31.21	
1960-61	25.03	25.96	25.03	23.06	21.98	21.97	23.14	23.84	24.30	24.86	25.35	26.15	24.22
1961-62	24.99	24.61	25.19	25.86	25.12	23.68	23.74	24.22	25.46	26.57	27.23	28.05	25.39
1962-63	27.35	25.39	25.74	26.40	26.36	25.39	25.80	27.01	28.46	28.76	28.94	29.81	27.12
1963-64	28.49	25.60	25.51	25.92	24.88	22.38	22.18	21.76	21.44	24.40	25.20	27.20	24.58
1964-65	28.00	27.20	30.40	30.80	30.00	28.80	27.20	29.60	30.40	31.20	32.40	34.80	30.07
Average	26.77	25.75	26.37	26.41	25.67	24.44	24.41	25.29	26.01	27.16	27.82	29.20	
1965-66	36.40	36.40	37.20	35.20	35.20	33.20	34.40	33.20	34.40	37.60	39.20	39.60	36.00
1966-67	45.20	47.20	52.40	49.60	46.50	42.40	42.80	46.40	44.80	44.80	47.20	47.60	46.43
1967-68	48.40	46.00	46.40	46.00	43.60	39.60	38.40	37.60	36.80	38.40	40.40	46.00	42.30
Average	43.33	43.20	45.33	43.60	41.87	38.40	38.53	39.07	38.67	40.27	42.27	44.40	

Source:- 1) Food Department, Government of Bangladesh [6, Table A-9].

2) Bangladesh Bureau of Statistics, Monthly Bulletin of Statistics, various issues [3].

TABLE - 2

Monthly Provincial Average of Wholesale Prices of Medium Quality Rice in Bangladesh
(Taka per Maund)

Year	July	August	September	October	November	December	January	February	March	April	May	June
1952-53	26.78	25.13	25.14	26.63	25.25	22.19	22.50	22.00	22.06	22.38	25.51	25.34
1953-54	25.57	24.12	24.57	23.88	20.25	18.07	17.00	15.75	15.98	15.19	14.97	14.82
1954-55	13.50	14.38	15.00	14.35	12.98	13.19	13.32	12.62	12.53	13.85	15.22	17.57
Average	21.95	21.21	21.57	21.62	19.49	17.82	17.61	16.79	16.86	17.14	18.57	19.24
1955-56	17.63	18.13	19.57	21.64	22.22	20.50	20.00	24.06	26.58	27.21	28.23	34.31
1956-57	40.07	37.38	44.53	43.81	35.50	23.47	23.91	24.50	30.31	31.19	33.94	33.63
1957-58	29.57	27.35	29.22	26.25	22.31	22.75	22.69	21.98	24.52	25.25	28.46	28.00
1958-59	26.56	26.84	26.50	25.11	24.08	22.06	22.65	25.90	28.29	28.42	28.02	31.35
1959-60	30.67	30.83	30.48	29.44	27.75	23.94	24.25	25.25	26.98	28.71	31.67	33.72
Average	29.50	28.11	30.06	29.25	25.97	22.54	22.70	24.26	27.34	28.16	30.06	32.20
1960-61	31.53	29.47	30.09	28.63	-	25.66	24.75	24.94	25.85	27.13	27.36	28.02
1961-62	26.37	26.66	27.62	29.08	27.84	24.82	24.70	24.04	25.02	26.62	27.49	28.42
1962-63	27.59	27.77	28.50	28.58	28.90	27.22	26.98	28.09	30.07	30.28	31.50	33.16
1963-64	33.04	31.06	30.54	29.52	29.20	25.98	24.19	22.85	22.17	22.07	24.39	24.81
1964-65	25.58	25.94	28.58	28.47	26.77	25.27	25.22	27.11	25.76	27.41	27.57	31.07
Average	28.82	28.18	29.07	28.86	28.18	25.79	25.17	25.41	25.57	26.70	27.66	29.10
1965-66	31.85	30.51	33.08	32.24	31.54	28.89	29.39	29.68	30.76	33.36	33.96	35.82
1966-67	42.70	47.53	50.90	48.30	47.13	33.08	39.41	41.27	41.00	42.99	43.96	44.69
1967-68	43.90	39.50	39.90	41.12	38.50	35.05	33.54	33.66	33.90	35.64	36.75	39.85
Average	39.48	39.18	41.77	40.55	39.06	34.01	33.21	34.87	35.22	37.33	38.22	40.12
Average of the whole period	29.74	28.91	30.26	29.82	28.01	24.82	24.65	25.21	26.65	27.36	28.69	30.29

TABLE - 3

Average Monthly Price of Fine Quality Rice
(Tk. Per Maund)

Year	July	August	September	October	November	December	January	February	March	April	May	June
1960-61							27.25	26.50	26.17	28.00	29.88	32.25
1961-62	32.20	32.75	36.60	38.25	36.88	28.80	26.25	26.38	28.80	31.00	32.38	33.20
1962-63	33.50	35.62	36.20	38.00	36.75	31.60	30.25	32.50	33.10	33.50	33.63	34.60
1963-64	36.90	36.10	38.38	38.06	35.85	26.50	34.08	25.86	24.94	23.69	22.88	26.40
1964-65	26.31	28.13	28.90	34.25	34.50	33.80	32.17	28.49	31.89	32.04	34.59	36.52
Average	32.13	32.65	35.02	37.14	36.00	30.18	30.00	27.95	28.98	29.65	30.67	32.59
1965-66	38.30	39.42	39.70	38.92	38.41	34.75	32.46	34.28	34.54	36.72	40.50	41.42
1966-67	45.73	49.38	54.50	53.44	43.33	44.14	44.33	46.10	45.68	47.35	51.96	59.82
1967-68	49.32	48.40	48.50	49.25	48.17	41.82	40.21	38.70	37.90	40.18	42.14	45.62
Average	44.45	45.73	47.57	47.07	44.97	40.24	39.00	39.69	39.37	41.52	44.87	48.95
Average of the whole period	37.41	38.26	40.40	41.40	39.84	34.49	33.38	32.35	32.88	34.10	36.00	38.73

Source: 1) Bangladesh Bureau of Statistics, Monthly Bulletin of Statistics, Various issues, See [3].

2) Government of Bangladesh, Weekly Information, various issues, See [6].

TABLE - 4

Average Monthly Prices of Coarse Rice
(Tk. per maund)

Year	July	August	September	October	November	December	January	February	March	April	May	June
1952-53	-	-	-	-	-	-	18.63	19.59	19.96	21.25	21.96	23.06
1953-54	21.33	20.00	21.21	19.25	14.92	13.13	14.00	13.42	13.46	11.38	11.25	11.96
1954-55	11.79	11.83	12.92	11.33	9.42	9.71	10.17	9.88	9.63	10.06	10.21	13.81
Average	16.56	15.92	17.07	15.29	12.17	11.42	14.27	14.30	14.35	14.23	14.47	16.28
1955-56	13.07	13.56	16.87	15.64	19.12	17.50	17.79	22.72	23.23	25.87	29.71	24.08
1956-57	20.00	20.00	20.00	-	20.00	20.00	21.67	20.00	23.75	23.75	26.50	34.50
1957-58	-	25.00	-	23.00	20.84	23.66	22.89	22.44	25.31	25.96	28.56	27.58
1958-59	27.08	26.67	27.25	25.40	25.04	21.33	21.25	24.58	27.44	28.25	27.25	28.27
1959-60	28.54	28.37	28.33	26.29	24.35	23.06	24.54	24.85	25.98	27.69	28.33	24.67
Average	22.17	22.72	23.11	22.58	21.87	21.11	21.63	22.92	25.14	26.30	28.07	27.82
1960-61	24.39	23.42	23.83	22.65	22.54	23.33	24.50	2400	24.17	25.30	25.85	26.75
1961-62	28.00	27.25	27.80	28.25	27.50	23.80	24.38	24.38	25.80	27.00	29.00	30.00
1962-63	29.50	27.38	30.00	29.75	29.75	28.30	27.65	29.13	29.40	29.75	28.88	30.00
1963-64	30.17	30.25	28.00	27.69	27.00	24.00	23.29	21.63	21.25	20.75	24.70	23.31
1964-65	24.25	26.25	25.75	27.38	25.65	23.88	25.70	27.13	28.25	28.38	30.30	28.75
Average	27.26	26.91	27.08	27.14	26.49	24.66	25.10	25.25	25.77	26.24	27.75	27.76
1965-66	31.70	32.00	32.50	31.50	31.25	27.56	28.01	29.33	31.60	34.22	36.06	37.20
1966-67	41.12	42.14	44.40	42.52	38.67	37.60	39.95	39.68	39.95	41.70	44.32	42.69
1967-68	42.81	40.10	39.50	38.81	37.41	33.14	32.33	31.60	30.97	34.62	34.95	37.87
Average	38.54	38.08	38.80	37.61	35.78	32.77	33.43	33.54	34.17	36.85	38.44	39.25
Average of the whole period	26.70	26.28	27.03	26.39	24.90	23.33	23.55	24.02	25.01	26.00	27.38	27.78

Source:- 1) Government of Bangladesh, Weekly Information, Various issues, See [6].

2) Bangladesh Bureau of Statistics, Monthly Bulletin of Statistics, Various issues, See [3].

TABLE - 5

Yearly Average Wholesale Prices of Medium Quality Rice in Bangladesh

Years	Price[a/] per maund	Price per Ton
	Rs.	Rs.
1951-52	23.92	651.10
1952-53	22.88	622.79
1953-54	18.88	513.91
1954-55	13.83	376.45
1955-56	22.31	607.28
1956-57	28.85	785.30
1957-58	25.12	683.77
1958-59	26.27	715.07
1959-60	28.73	782.03
1960-61	27.15	739.02
1961-62	26.55	722.69
1962-63	29.01	789.65
1963-64	27.07	736.84
1964-65	27.51	748.82
1965-66	32.53	885.47
1966-67	42.41	1,154.40
1967-68	37.29	1,012.31

a/ Prices are the averages of Dacca, Chittagong, Sylhet, Rajshahi and Khulna Prices. Provincial average wholesale price, as such, is not available for all the year.

Source:- Central Statistical Office, Pakistan Statistical Year Book, 1963, Page 294 and 1968, Page 401. [1].

TABLE - 6

Availability of Rice From Provincial Production

Year	Production (Million Tons)	Availability (Million Tons)
1951-52	7.030	6.327*
1952-53	7.340	6.606*
1953-54	8.240	7.416*
1954-55	7.590	6.831*
1955-56	6.380	5.742
1956-57	8.190	7.371
1957-58	7.600	6.840
1958-59	6.920	6.228
1959-60	8.480	7.632
1960-61	9.519	8.557
1961-62	9.465	8.519
1962-63	8.730	7.857
1963-64	10.456	9.419
1964-65	10.337	9.303
1965-66	10.335	9.301
1966-67	9.397	8.458
1967-68	10.986	9.888

* Estimated.

Source:- Bangladesh Bureau of Statistics, Statistical Digest of Bangladesh, No.2, 1964, page 55. and No.5, 1968 page 138 [4].

TABLE - 7

Estimated Aggregate Real Demand for Foodgrains

Year	Provincial Population (Millions)	Gross Provincial product per capita (Rs.)	Ag. Real demand (Million Tons)
1951-52	44.89	294.50	6.509
1952-53	45.92	296.75	6.704
1953-54	46.98	299.64	6.906
1954-55	48.06	287.47	6.921
1955-56	49.17	269.15	6.835
1956-57	50.30	286.42	7.193
1957-58	51.46	275.96	7.204
1958-59	52.64	262.61	7.212
1959-60	53.85	278.03	7.593
1960-61	55.25	286.62	7.901
1961-62	56.69	296.30	8.220
1962-63	58.16	289.29	8.317
1963-64	59.67	312.90	8.891
1964-65	61.22	320.24[b]	9.244
1965-66	62.87	327.41[b]	9.619
1966-67	64.57	334.72[b]	10.008
1967-68	66.49[a]	341.31[b]	10.439

a/ Estimated at 2.6 per cent compound rate of growth

b/ Estimated at 5 per cent rate of growth in GPP.

Source: 1) For population figures see [4, No.5, 1968, page 11].

2) For GPP see [8, pages 199-200].

TABLE - 8

Imports of Foodgrains into Bangladesh

Year	Quantity (Million Tons)
1955-56	0.170
1956-57	0.590
1957-58	0.670
1958-59	0.466
1959-60	0.612
1960-61	0.698
1961-62	0.408
1962-63	1.436
1963-64	1.002
1964-65	0.345
1965-66	0.923
1966-67	1.280
1967-68	1.150

Source: See [4, No.5, 1968, Page 139].

TABLE - 9

Estimated Money Supply in Bangladesh as in December[a/]

Year	Money Supply in Pakistan(December)	Money Supply in Bangladesh(December
1951-52	363.6	105.4
1952-53	310.6	90.1
1953-54	346.1	100.4
1954-55	369.5	107.1
1955-56	429.1	124.4
1956-57	483.8	140.3
1957-58	509.6	147.8
1958-59	540.1	156.6
1959-60	567.2	167.1
1960-61	608.2	176.4
1961-62	612.4	177.6
1962-63	643.6	186.6
1963-64	736.1	213.5
1964-65	864.7	250.8
1965-66	940.2	252.7
1966-67	1,074.4	311.6
1967-68	1,044.0	302.0

a/ The figures for money supply in Bangladesh are estimated. The money supply in Bangladesh has been assumed to be 29 per cent of over all money supply in Pakistan. For reasons behind this assumption see the text when money supply variable is defined.

Source: For money supply in Pakistan see [1, 1968, page 344].

TABLE - 10

(Model 1)

Explanatory Variable	Reg.Coeff.	SE of(2)	T-Value	Beta coefficient
R	-80.90	42.31	1.91	
D	+187.28	42.94	4.36	
		(Model II)		
R_t	-20.85	71.195	.2928	
D_t	-108.95	146.762	.7424	
M	+ 4.38	2.052	2.135	
		(Model III)		
R	-63.27	62.40	1.014	
D	135.63	41.59	3.261	
I	108.07	74.31	1.454	

TABLE - 11

	Model 1	Model II	Model III
R^2 unadjusted	.7233	.7930	.7879
R^2 adjusted	.6837	.7452	.7172
F	18.30	16.60	11.14
Intercept	22.22	988.14	93.80